International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

PHYSICS 0625/5

PAPER 5 Practical Test

Friday **28 MAY 1999** Morning 1 hour 15 minutes

Candidates answer on the enclosed answer booklet.
Additional materials:
As listed in Instructions to Supervisors
Electronic calculator and/or Mathematical tables
300 mm rule

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer booklet.

Answer **all** questions.

Write your answers in the spaces provided on the answer booklet.

You are expected to record all your observations as soon as these observations are made. These observations and any arithmetical working of the answers from them should be written in the answer booklet; scrap paper should **not** be used.

An account of the method of carrying out the experiments is **not** required but you should record any precautions you take, and it must be clear (by diagrams or otherwise) how the readings were obtained. The theory of the experiments is **not** required.

At the end of the examination, hand in only the answer booklet.

INFORMATION FOR CANDIDATES

Graph paper is provided in the enclosed answer booklet. Additional sheets of graph paper should be used only if it is necessary to do so.

This question paper consists of 7 printed pages, 1 blank page and an inserted answer booklet.

SB (CW/TC) QF91702/3

1 A length of resistance wire acting as a heating coil has been wound around the bulb of a thermometer. In this experiment, you are to investigate how the temperature of the thermometer bulb increases with time.

All of your observations and answers should be recorded on pages 2 and 3 of your Answer Booklet.

Carry out the following instructions, referring to Fig. 1.1.

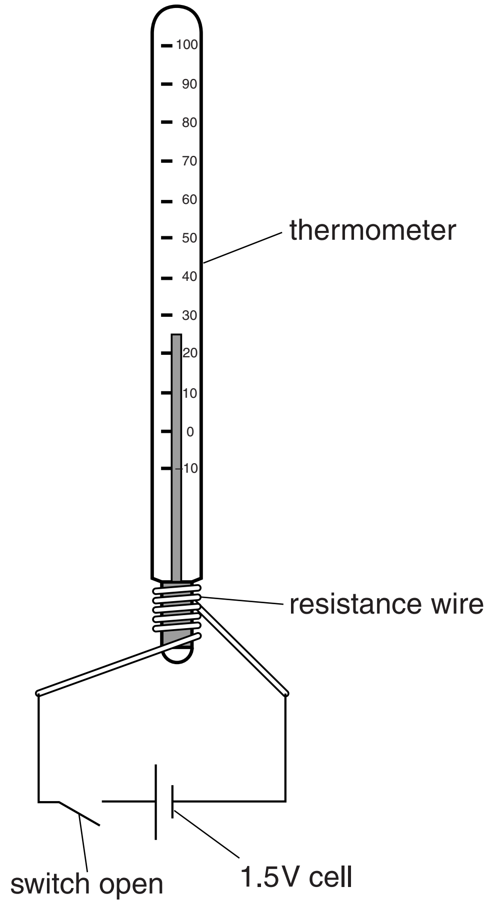

Fig. 1.1

The resistance wire around the thermometer bulb will become hot.

(a) The apparatus in Fig. 1.1 has been set up for you with the switch open.

Record, in Table 1 in your Answer Booklet, the initial temperature reading T_0 on the thermometer for time $t = 0$.

(b) Close the switch and immediately start the stopclock. Record the temperature reading every 15 seconds for 2 minutes.

If the temperature reading reaches 100 °C, open the switch and ask for help.

Open the switch.

(c) On the grid provided on page 3 of your Answer Booklet, plot a graph of temperature/°C [*y*-axis] against time/(minutes:seconds) [*x*-axis].

Draw the line of best fit.

(d) Draw a straight line touching your graph, (a tangent), at time $t = 1$ minute. Calculate the increase in temperature per second (the gradient of this tangent) at time $t = 1$ minute.

(e) A student using identical apparatus records an initial temperature of 20 °C and after **one** minute a temperature of 74 °C. On the grid on page 3, sketch an appropriate line to represent this heating.

2 In this experiment, you are to investigate the extension of a rubber band.

All of your observations and answers should be recorded on page 4 of your Answer Booklet.

Carry out the following instructions, referring to Fig. 2.1.

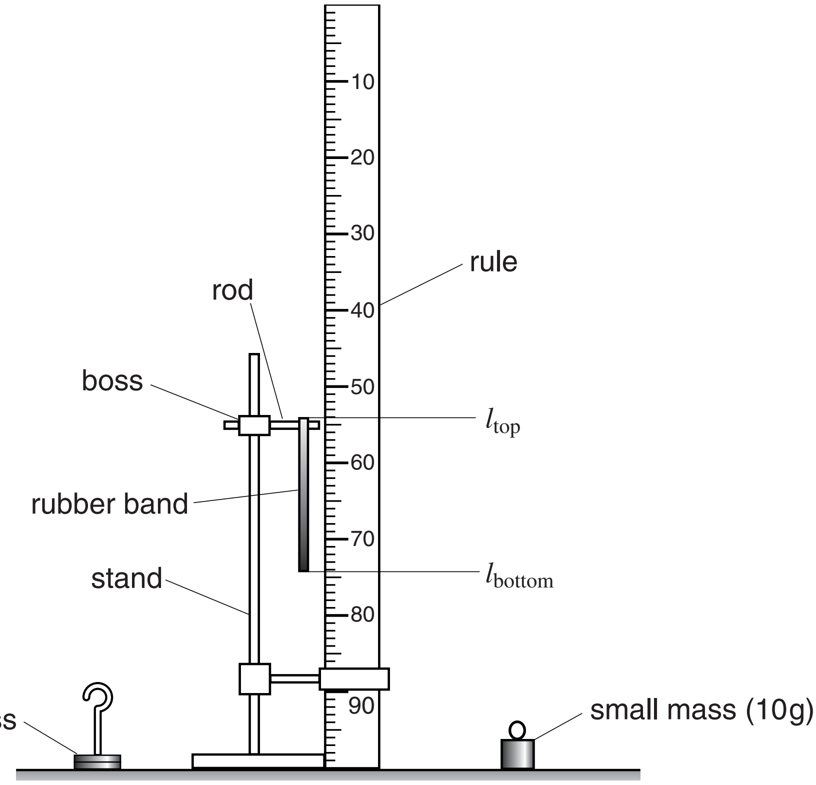

Fig. 2.1

(a) In the first part of this experiment, you are to determine the unextended (or original) length l_0 of the rubber band.

Hang the rubber band from the rod.

Explain why it is not possible to measure l_0 accurately as the band hangs from the rod.

Hang the small mass (10 g) from the band. Adjust the height of the rod by slackening the boss and moving the rod up or down to give a more convenient scale division on the rule at which to read l_{top}. Record the value of l_{top}. Record the value of l_{bottom}. Calculate l_0, the unextended length of the band, and record the value in your Answer Booklet.

Why did this procedure make it more convenient to measure l_0?

Why did the mass have to be small?

Remove the small mass.

[Turn over

(b) Now hang the 100 g mass from the band.

You have been provided with

(i) a 30 cm ruler,

(ii) a large pin with a lump of Blu-Tack or Plasticine fastened at the blunt end.

Use one of these two items **(i)** or **(ii)** to improve the accuracy with which you can measure l_{bottom}. Describe how you have used **one** of these items to do this.

Record the value of l_{bottom} in the table and calculate l_1, the new length of the band. Record l_1, in column 3 of the table.

(c) Repeat the procedure in **(b)** for four further masses of 200 g, 300 g, 400 g and 500 g. Calculate and record the corresponding values of l_2, l_3, l_4 and l_5, in column 3 of the table.

Leave the 500 g mass hanging from the band while you complete column 3 of the table.

(d) You are now to record any changes that have occurred in the extension of the band during the last two or three minutes.

Record the new value of l_{bottom} for the 500 g mass in column 4 of the table.

Remove the masses, 100 g at a time, recording the new values of l_{bottom} in column 4 of the table.

Calculate the new values of l_5, l_4, l_3, l_2 and l_1.

(e) Use the data in columns 3 and 5 of the table to comment on how the length of the rubber band changes as the mass is increased.

3 In this experiment, you are to investigate the paths of rays of light as they pass through a rectangular transparent block.

All of your observations and answers should be recorded on pages 6 and 7 of your Answer Booklet.

Carry out the following instructions, referring to Fig. 3.1.

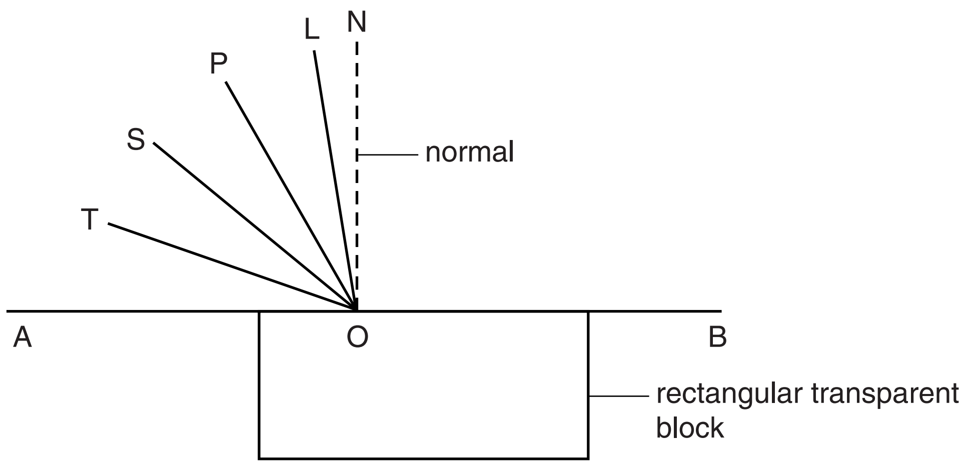

Fig. 3.1

(a) From the diagram on page 6 of the Answer Booklet measure the length, in mm, of the line AB. Record this value and also record the value in **metres**.

Measure the angles LON, PON, SON and TON. These will be the angles of incidence of the light at O. Record the values in the table.

(b) Place the rectangular transparent block with its longest side along the line AB. Approximately $\frac{3}{4}$ of the block must be to the right of O.

Draw around the block making your line as close to the edge of the block as possible.

(c) Shine a ray of light along the line LO into the block. The ray of light that leaves the block opposite the point O is called the emergent ray. Mark with two widely-spaced crosses the centre of the emergent ray.

Remove the block and draw a line through the two crosses to mark the path of the emergent ray. Label the point where this line emerges from the block with the symbol L_1 and the opposite end of this emergent ray with the symbol L_2.

Draw a line through the points O and L_1. This is the refracted ray.

(d) Replace the block and repeat part **(c)** for lines PO, SO and TO. Label the ends of the emergent rays with P_2, S_2 and T_2. Label the ends of the refracted rays as P_1, S_1 and T_1 respectively.

Remove the block.

(e) Extend the normal line NO through where the glass block was placed. Label the end of the line N_1.

Measure the angles of refraction L_1ON_1, P_1ON_1, S_1ON_1, T_1ON_1. Record these values in the table.

(f) **(i)** State what has happened to the angles of refraction by completing the tick boxes on page 7 of your Answer Booklet.

(ii) State what has happened to each refracted ray by completing the tick boxes.

4 In this experiment, you are to calculate the density of three different materials.

All of your observations and answers should be recorded on pages 8 and 9 of your Answer Booklet.

Carry out the following instructions, referring to Fig. 4.1.

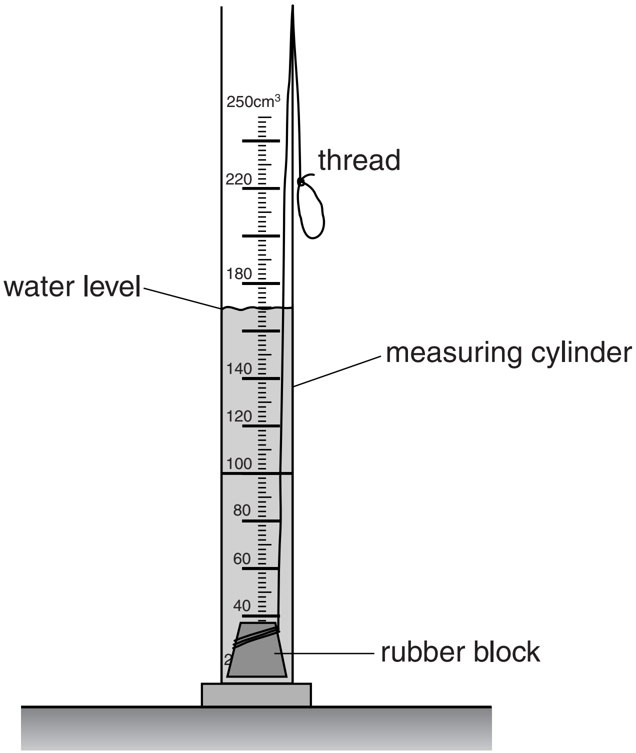

Fig. 4.1

(a) Record the largest volume of water that your measuring cylinder can measure.

Record the smallest volume of water that your measuring cylinder can measure.

Copy the mass of each of the blocks into the table in your Answer Booklet.

(b) In this experiment you are to lower three objects, in turn, into water in the measuring cylinder. You will then use the changes in the water level to calculate the volume of each of the objects.

Pour sufficient water into the measuring cylinder so that when each object is lowered into the cylinder it will be totally immersed. Choose a volume that will make your calculations easy.

Record this volume.

(c) Lower the rubber block into the measuring cylinder until it is totally immersed. Record the total volume of the water and block.

Use your results to calculate the volume of the block and record this volume in the table.

(d) Use the formula below to calculate the density of the rubber.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(e) Repeat **(c)** and **(d)** for the metal block.

(f) Lower the wooden block into the measuring cylinder.

Why are you unable to calculate the volume of the block as in **(c)**?

(g) Leave the wooden block in the measuring cylinder and lower the metal block on to the top of the wooden block so that both blocks are totally immersed.

Measure and record the new total volume.

(h) Use your results to calculate the volume of the wooden block. Then calculate the density of the wood.

(i) Mark, on the chart on page 9 of your Answer Booklet, the values of the densities you have obtained for rubber, metal and wood. The density of water has been marked for you.

Use this information to explain why two of the blocks sank and the other block floated when placed in the water.

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